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$$\therefore \frac{r + (z-r) \sec \theta}{u} = \frac{yz}{m}. \quad \therefore y = \frac{m}{uz} (r - r \sec \theta + z \sec \theta) = y'.$$

The limits of θ are 0 and 2π ; of z , 0 and $2r$ for total, and $r(1 + \cos \theta) = z'$ to $r(1 - \cos \theta) = z''$ for favorable cases; of y , 0 and $2\sqrt{(2rz - z^2)} = y''$ for total, and 0 and y' for favorable cases.

$$\begin{aligned} \therefore p &= \frac{\int_0^{2\pi} \int_{z''}^{z'} \int_0^{y'} d\theta \, dz \, dy}{\int_0^{2\pi} \int_0^{2r} \int_0^{y''} d\theta \, dz \, dy} = \frac{1}{2\pi^2 r^2} \int_0^{2\pi} \int_{z''}^{z'} \int_0^{y'} d\theta \, dz \, dy \\ &= \frac{m}{2\pi^2 r^2 u} \int_0^{2\pi} \int_{z''}^{z'} \frac{(r - r \sec \theta + z \sec \theta) d\theta \, dz}{z} \\ &= \frac{m}{\pi^2 r u} \int_0^{2\pi} (1 + \sec \theta \log \tan \tfrac{1}{2} \theta - \log \tan \tfrac{1}{2} \theta) d\theta = \frac{2m}{\pi r u}. \end{aligned}$$

Therefore the chance of meeting one derelict out of the n is $\Sigma p = 2nm/\pi ru$, and the probability that e will be encountered is

$$\Pi \left(\frac{2nm}{\pi ru} \right) = \left(\frac{2nm}{\pi ru} \right)^e.$$

CALCULUS.

203. Proposed by S. A. COREY, Hiteman, Iowa.

$$\text{Evaluate* } \int_0^\pi \frac{\sin mx \, dx}{x}.$$

Solution by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.

$$\begin{aligned} \int_0^\pi \frac{\sin mx}{x} dx &= \int_0^\pi \left(m - \frac{m^3 x^2}{3!} + \frac{m^5 x^4}{5!} - \frac{m^7 x^6}{7!} + \dots \right) dx \\ &= m\pi \left(1 - \frac{m^2 \pi^2}{3.3!} + \frac{m^4 \pi^4}{5.5!} - \frac{m^6 \pi^6}{7.7!} + \dots \right). \end{aligned}$$

Also solved by L. E. Newcomb.

204. Proposed by M. E. GRABER, A. M., Heidelberg University, Tiffin, Ohio.

Required the variation of $\int V dx$ where V is a function of $x, y, \frac{dy}{dx}, \frac{d^2 y}{dx^2}, \dots$

and v where $v = \int V' dx$ and V' is also a function of $x, y, \frac{dy}{dx}, \frac{d^2 y}{dx^2}, \dots$

*See Byerly's *Integral Calculus* (p. 23, Table of Integrals) Formulae 211 and 241. A solution not in the form of an infinite series would also be desirable.